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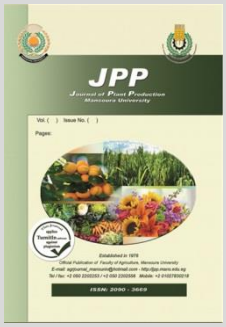
Effect of N-Levels and Foliar Application Treatments on Productivity of Sunflower

Badawi, M. A.; A. N. E. Attia; S. E. Seadh and Amal E. E. Awad*

Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt.



ABSTRACT

Field experimentations were carried out to examine the impact of N-levels and foliar application treatments on yield characters of sunflower cultivar Sakha-53 during 2016 and 2017 seasons at El-Muhandis Village in Sherbin District, Dakahlia Governorate, Egypt. Experimentations were conducted using a strip plot design with three replicates. Vertical plots were devoted to nitrogen fertilizer rates (20, 25 and 30 kg N/fed). While, six spraying transactions *i.e.* without, water spraying, amino acids (AA), yeast extract (YE), commercial NPK + micro elements (Fe, Mn and Cu) as Estima-Green powder, and the mix of AA, YE and commercial NPK + micro-elements were distributed on the horizontal plots. Fertilizing with 30 kg N/fed yielded the maximum rates of yield and its attributes during 1st and 2nd years. Fertilizing with 25 kg N/fed came after the maximum rate of N fertilizer. The spraying two times with the mix of AA, YE and commercial NPK + micro-elements gave the maximum rates of crop and its components in both years, then spraying sunflower plants twice with commercial NPK + Micro (1.5 g/L) in every spray. It can be accomplished that sunflower cultivar Sakha-53 with 25 kg N fed^{-1} as well as spraying twice with the mix of AA, yeast extract and commercial NPK + Micro so as to preserve high productivity at the same time decrease production expenses and ecological contamination under the ecological circumstances of Dakahlia- Governorate, Egypt.

Keywords: Sunflower, N-levels, Amino acids (AA), Foliar spraying, Yeast extract (YE), Micro and macro elements, Yield.

INTRODUCTION

Sunflower (*Helianthus annuus* L.*)* is one of the most edible oilseed of *Asteraceae* family. It is a substantial oilseed crop came after soybean and peanut accompanied by other oil seed crops like (canola and cotton), which participates significantly to edible oil all over world (Thavaprakash *et al*., 2002). Its no cholesterol and elevated unsaturated fatty acids content (Khalifa and Awad, 1997). Sunflower oil also has premium dietetic qualities without poisonous components and has a comparatively towering condensation of linoleic acid (Seiler, 2007).

It is recognized that cephalic extending and maximize output of any crop might be attained by utilization proper agronomic pursuits. Additionally, the marked impact of the agronomical pursuits for instance utilization new cultivars, appropriate N-fertilizer rate in addition to foliar application with AA, YE as well as macro and micro-elements that has awfully major influence on yield and its attributes of sunflower plant.

Nitrogen (N) is the most substantial nutrient of fertilizers given to sunflower. In this concern, Munir *et al*. (2007) revealed that highest achenes yield were attained by adding of NPK at the rate of 50:75:50 kg per ha in the two growing seasons. Bakht *et al*. (2010) indicated that the maximum achenes yield per unit area were resulted from fertilizer treatment of 150 kg N/ha in both years. Namvar *et al*. (2012) examined the influences of chemical N-fertilization rates (0, 100, 150 as well as 200 kg N per ha) on achenes yield and yield components of sunflower. They noticed that the highest disc girth, number of seeds per head, thousand achene weight and achenes yield were attained by 200 kg N per ha. Awais *et al*. (2013) said that implementation of 150 kg N ha^{-1} was best treatment to attain maximum seed yield. Khan *et al*. (2014) found that the rising in N-levels from 30 to 90 kg/ha showed a significant increase in yields. This increase in yields were mainly related with increase in head girth, seeds number per head and seeds weight per heads. Nasim *et al*. (2016) revealed that the implementation of N at raised level of 180 kg/ha gave elevatest yields as compared to standard level (120 kg per ha). Kandil *et al*. (2017) showed that the raises in N-fertilizer levels to 168 kg N/ha resulted the elevatest number of seeds/disc, disc girth, thousand seed weight and seed yield/ha. They found that rising N-fertilizer from 72 to 168 kg N/ha considerably raised achenes yield by 12.0 also 11.6%. Morsy *et al*. (2018) indicated that implementation of N at 30 kg N fed^{-1} mineral + 15 kg N fed^{-1} organic (N_3) increased achenes yield (t fed^{-1}) by 5.95 also 9.20% in the first and second years, in that order as compared to the N_2 treatment. The maximum achenes yield (1.90 also 1.91 t fed^{-1}) was registered from 30 kg N fed^{-1} mineral + 15 kg N fed^{-1} organic in the first and second years, in that order.

Among the methods of fertilizer application, foliar nutrition is recognized as significant method of fertilization. In this respect, Akram and Ashraf (2011) indicated that foliar application with 5-amino levulinic acid improved growth 0, 20, 50 and 80 mg/liter rates of 5-amino levulinic acid were comparatively more efficient than the another rates utilized in this research. Jabeen and Ahmad

* **Corresponding author.**
E-mail address: amalelsayed@mans.edu.eg
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(2012) studied the impact of foliar application of nutrient sols (H_3BO_3, KNO_3, Fe-EDTA and its combination) was sprinkled three times, *i.e.*, 45, 75 also 95 DAS. KNO_3 was sprayed at 250 ppm and other H_3BO_3 also Fe-EDTA was sprayed at 5 ppm. Amongst the nutritious sols, combination of KNO_3 + H_3BO_3 + Fe-EDTA was the most efficient, then H_3BO_3 also Fe-EDTA. Laghari *et al.* (2014) revealed that foliar N-concentration 1.0% and 1.5% considerably influenced and higher values found for head girth, seeds weight per head,' seed index and seed yield, whilst more seeds number per head were found at nitrogen conc. 1.5% and the lowest performance of sunflower characters observed in non treated plots. Soomro *et al.* (2015) mentioned that application 3% N/ha in the form of urea had significant effect on all seed yield components. Baraich *et al.* (2016) found that applying of Zn, B and Fe at the amount of 8, 0.75 and 0.30 kg per ha raised head girth, achenes number per plant, achenes weight per head, seed index and achenes yield by 27%, 13%, 34%, 19%, 24% and 31%, respectively over control. Morsy *et al.* (2018) indicated that foliar application of yeast extract (YE) at 3 g/liter produced the maximum amounts of seed yield during 1st and 2nd years when contrasted with salicylic acid also ascorbic acid transactions. Bochalya *et al.* (2019) reported that utilizing a foliar spraying with N P K 10:26:26 at 1.5% improved yield of sunflower considerably as contrasted to the other transactions.

Therefore, this research was set up to estimate the impact of mineral nitrogen levels and foliar fertilizers treatments on productivity of sunflower cultivar Sakha-53 under the ecological conditions of Governorate of Dakahlia, Egypt.

MATERIALS AND METHODS

Two farm experimentations were took place at El-Muhandis hamlet, Sherbin District, Dakahlia-Governorate, Egypt, through the two succeeding summer seasons of 2016 also 2017. The most important target of this research was to decide the impact of N-levels, spraying treatments and their interact on crop and its components cultivar of sunflower (Sakha-53).

These experiments were conducted in design of a strip plot with three replicates. Where, the cephalic-plots were assigned to three N-rates (20, 25 and 30 kg N per fed).

Horizontal-plots were allowed to the subsequent six spraying transactions.

1. Without (control transaction).
2. Spraying with water.
3. Amino acids (1.5 g liter^{-1} water) in every spray.
4. Yeast extract (150 ml liter^{-1} water) in every spray.
5. Commercial fertilizer, Estima-Green powder as a resource of NPK + micro-elements (1.5 g liter^{-1} water) in every spray.
6. The mix of AA, YE and NPK + micro (Fe, Mn and Cu) at the above mentioned rates of them in all spraying.

Spraying sol quantum was 200 L per fed and foliar application was performed by using hand sprayer till saturation (twice after 37 and 51 days from sowing). Tween-20 was utilized as a moistening operator at 0.02% condensation.

Each experimental plot contained 5 ridges, every of 3 m longitude and 70 cm width, the experimental unit area (10.5 m^2, 1/400 fed).

Ground patterns were collected from the experimental farm unit area at a deepness of 0 - 30 cm from ground flatness before soil elaboration as well as after harvesting during the succeeding seasons to evaluate the physiochemical characters as indicated in Table 1.

Table 1. Mechanical and chemical ground analyses at the experimental sites prior soil preparation and after harvesting during 2016 and 2017 seasons.

Soil analysis		Before soil preparation		After harvesting	
		2016 season	2017 season	2016 season	2017 season
A. Mechanical analysis:					
Sand %		20.3	22.6	18.2	19.5
Silt %		42.2	43.1	40.1	39.2
Clay %		37.5	34.3	41.7	41.3
Texture Class		Muddy soil	Muddy soil	Muddy soil	Muddy soil
B. Chemical dissection:					
EC (1:5) dS m^{-1}		0.94	1.10	1.32	1.45
pH (1: 2.5)		8.12	8.14	8.05	8.01
Available N (ppm)		44.12	48.25	55.6	58.2
Available P (ppm)		4.64	5.11	5.7	6.1
Exchangeable K (ppm)		254.3	263.1	273.5	283.3
Cations (meq/100 g soil)	Ca^{++}	0.63	1.23	1.27	1.43
	Mg^{++}	0.35	0.93	0.71	0.94
	Na^{+}	3.11	2.28	4.53	4.42
	K^{+}	0.79	0.92	0.24	0.61
Anions (meq/100 g soil)	$CO3^{--}$	-	-	-	-
	HCO_3^{--}	0.68	0.94	1.32	1.87
	Cl^{-}	2.7	2.04	4.12	4.13
	$SO4^{--}$	1.5	2.38	1.31	1.40

The experimental field fully equipped. N-fertilizer in the format of ammonia nitrate (33.5% N) was subjoined at the previously aforesaid rates in two egalitarian portions, one semi prior the second irrigation and the other semi prior the third irrigation. Calcium superphosphate (15.5% P_2O_5) was subjoined through ground elaboration at the average of 100 kg per fed. 50 kg per fed in the form of Potassium sulphate (48% K_2O) was added with the 1st portion of N-fertilizer. The cultivation took place on 15th May in both seasons. Sunflower seeds were planted in

hills, 25 cm apart at the average of 2-3 seeds per hill utilizing dry planting mode (Afir) on 1 side of the ridges.

At the end of the flowering stage, the three inner ridges of every experimental unit were bagged with papers to avoid bird's damage. At harvesting, heads of three plants were collected from the inner ridges in every plot and were separated harvested, bagged, scrubbed from straw and other residues, then, the following measurements were made:

1. Head diameter (cm). 2. Head weight (g).
3. Number of seeds per head. 4. Thousand seed weight (g).
5. Seed yield/plant (g).
6. Seed yield/feddan (kg).

It was measured by gathering entire plants in the inner ridges in every plot, bagged, seeds scrubbed from straw and other residues and weighed in kilogram and modified to kg/fed.

In accordance with strip-plot designing, all data were statistically analyzed according (Gomez and Gomez, 1984). Least significant difference (LSD) mode was utilized for examine the differences between treatments at probability 5% level as characterized by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Effect of N-levels:

With respect to the impact of N-fertilizer rates on yield and its components *i.e.* head girth (cm), head weight (g), number of seeds/head, thousand seed weight (g), seed yield/plant (g) and seed yield/feddan (kg), it is obvious from acquired results showed that every raise in nitrogen fertilization rates was joined by considerable raise in all studied characters in the 1st and 2nd seasons as shown from results in Table 2.

Fertilizing sunflower plants with the maximum rate of N fertilizer (30 kg N) gave the maximum yield and its apparatuses in the two growing seasons. Nevertheless, mineral fertilizing sunflower plants with 25 kg N per fed followed the maximum rate of N fertilizer. Whilst, mineral fertilizing sunflower plants with 20 kg N per fed gave the poor values of all studied traits. These raises due to raised N fertilizer levels may be to the significant function of N in the plant is its existence in the building of nucleic acids and protein which play the majority significant structure and input materials of cells. Also, raised levels of nitrogen increase leaf area production and leaf area duration which lead to increase photosynthetic processes in addition to NAR (Munir *et al*., 2007). These consequences are in perfect accordance with those of Munir *et al*., (2007), Bakht *et al*. (2010), Namvar *et al*. (2012), Awais *et al*. (2013), Khan *et al*. (2014), Nasim *et al*. (2016), Kandil *et al*. (2017) and Morsy *et al*. (2018).

2. Effect of foliar application treatments:

About the influence of foliar application transactions *i.e.* without foliar spraying (control transaction), spraying sunflower plants two times with water only, amino acids (AA) at the rate of 1.5 g/L, yeast extract (YE) at the rate of 150 ml/liter water, Estima-Green powder as a resource of NPK + micro-elements (Fe, Mn and Cu) at the rate of 1.5 g/L water and the mix of AA, yeast extract and NPK + Micro (Fe, Mn and Cu) at the rate of 1.5 + 150 + 1.5 liter^{-1} water, in that order in every spray on yield and its components *i.e.* head diameter (cm), head weight (g), number of seeds/head, thousand seed weight (g), seed yield/plant (g) and seed yield/feddan (kg), it was considerable during 1st and 2nd years (Tables 2).

Table 2. Head diameter, head weight, number of seeds per head, thousand seed weight, seed yield per plant and seed yield per feddan of sunflower as influenced by N-rates also foliar spraying transactions in addition to their interaction through 2016 also 2017 seasons.

traits	Head diameter (cm)		Head weight (g)		Number of seeds per head		Thousand seed weight (g)		Seed yield per plant (g)		Seed yield per feddan (kg)	
Seasons / Treatments	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
A. N-levels:												
20 kg N fed^{-1}	14.5	14.5	81.6	72.7	1077.5	1067.0	54.75	54.13	58.07	48.03	1153.7	1121.6
25 kg N fed^{-1}	14.6	14.7	83.0	75.3	1082.6	1078.5	57.68	58.12	59.38	53.17	1280.1	1259.3
30 kg N fed^{-1}	15.4	15.2	85.2	77.8	1202.0	1197.2	59.27	60.78	61.55	53.93	1350.1	1328.0
LSD at 5 %	0.8	0.7	3.1	3.9	86.0	91.4	3.76	3.89	2.64	2.72	145.9	149.5
B. Foliar application treatments:												
Without	11.5	11.6	55.1	49.6	878.5	848.7	43.91	44.90	37.52	33.63	936.1	793.1
Water	14.0	13.4	67.4	56.6	970.4	960.2	47.45	48.69	48.40	38.15	1011.6	930.4
Amino acids (AA)	14.3	14.4	80.0	72.1	1067.5	1062.5	55.05	56.01	58.17	47.29	1132.5	1202.9
Yeast extract (YE)	15.4	15.3	86.6	79.2	1164.1	1163.3	59.55	58.20	63.65	55.21	1352.9	1342.9
NPK + Micro	16.1	16.1	101.2	92.0	1241.0	1254.6	65.54	66.01	72.22	63.68	1477.3	1475.2
AA + YE + NPK + Micro	17.8	17.8	109.2	102.0	1402.7	1396.0	71.91	72.25	78.05	72.29	1657.5	1673.2
LSD at 5 %	0.7	0.6	2.9	3.1	86.0	96.8	2.62	2.80	3.94	3.85	128.0	136.8
C. Interaction (F. test):												
A × B	NS	NS	*	*	*	*	*	*	*	*	*	*

It is obviously seemed that, spraying sunflower plants with the mix of AA, yeast extract and NPK + Micro (Fe, Mn and Cu) at the rate of 1.5 + 150 + 1.5 liter^{-1} water was the superior treatments to enchance yield and its components which gave the maximum rates of these traits in during 1st and 2nd years. It was pursued by spraying sunflower plants two times with Estima-Green powder as a resource of NPK + micro-elements (Fe, Mn and Cu) at the rate of 1.5 g litre^{-1} in every spray, then spraying sunflower plants two times with YE at the rate of 150 ml litre^{-1}, foliar spraying sunflower plants twice with amino acids at the rate of 1.5 g liter^{-1} water in every spray and spraying sunflower plants twice with water only in every spray during 1st and 2nd years. In contrast, control transaction (without spraying) produced the poor rates of all studied traits in both seasons. There is a direct link between foliar application and the vigors of the enzymatic systems of the plant. The timeliness and ready availability of elements

provided by foliar application stimulate enzymatic cycles to major efficiency and faster response (Bochalya *et al*., 2019). These consequences are in coincidence with those obtained by Akram and Ashraf (2011), Jabeen and Ahmad (2012), Laghari *et al*. (2014), Soomro *et al*. (2015), Baraich *et al*. (2016), Morsy *et al*. (2018) and Bochalya *et al*. (2019).

3. Effect of interaction:

Concerning the influence of the interaction, there are considerable influences of the interaction among N-levels and spraying treatments on all studied characters, with exception head diameter as showed in (Table 2).

Mineral fertilizing sunflower plants with 30 kg N fed^{-1} as well as spraying with the mix of AA, YE and NPK + Micro (Fe, Mn and Cu) resulted in highest values of head weight (Fig. 1), number of seeds/head (Fig. 2), thousand seed weight (Fig. 3), seed yield/plant (Fig. 4) and seed yield/feddan (Fig. 5) during 1st and 2nd years. The second greatest interaction transaction was mineral fertilizing sunflowers plants with 25 kg N fed^{-1} in addition spraying with the mix of AA, yeast extract and NPK + Micro (Fe, Mn and Cu) and pursued by mineral fertilizing sunflower plants with 20 kg N fed^{-1} and spraying with the mix transaction during 1st and 2nd years. These consequences are in harmony with those found by Siddiqui *et al*. (2009) and Morsy *et al*. (2018).

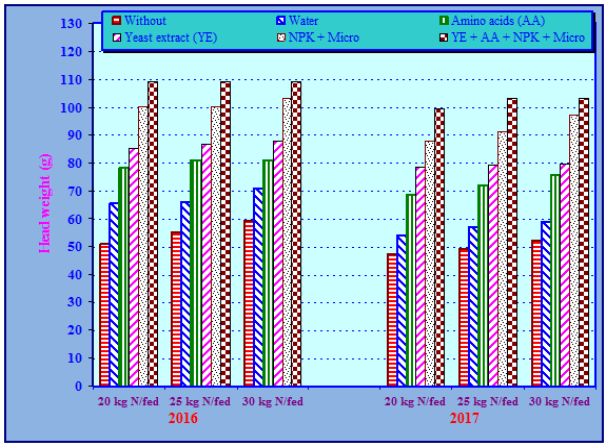

Fig. 1. Head weight (g) as influenced by the interaction among N-levels also foliar application transactions during 2016 and 2017 seasons.

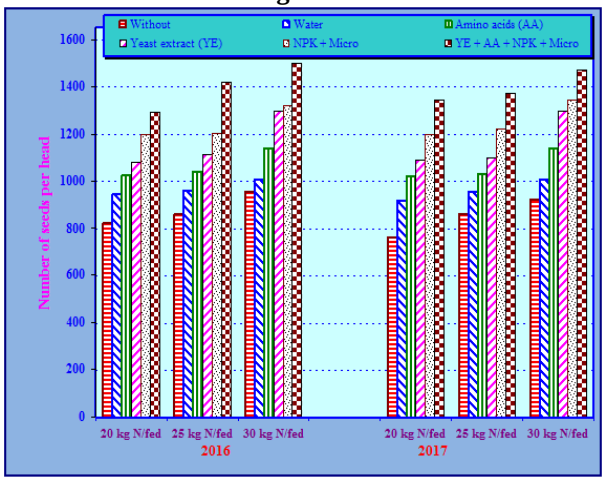

Fig. 2. Number of seeds per head as impacted by the interaction among N-levels and foliarapplication transactions through 2016 also 2017 years.

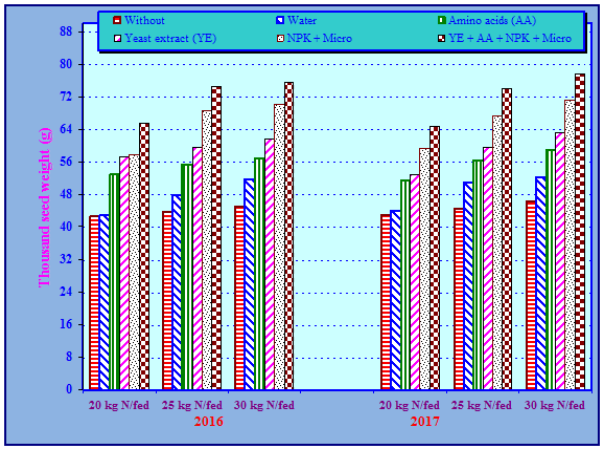

Fig. 3. Thousand seed weight (g) as influenced by the interaction among N-levels and foliar spraying transactions during 2016 plus 2017 seasons.

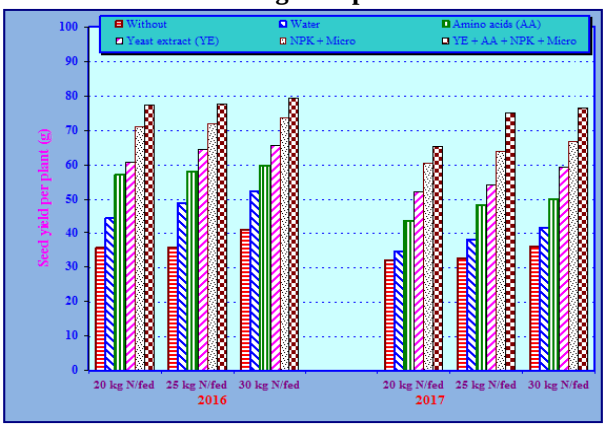

Fig. 4. Seed yield per plant (g) as influenced by the interaction among N-levels also foliar spraying transactions through 2016 plus 2017 seasons.

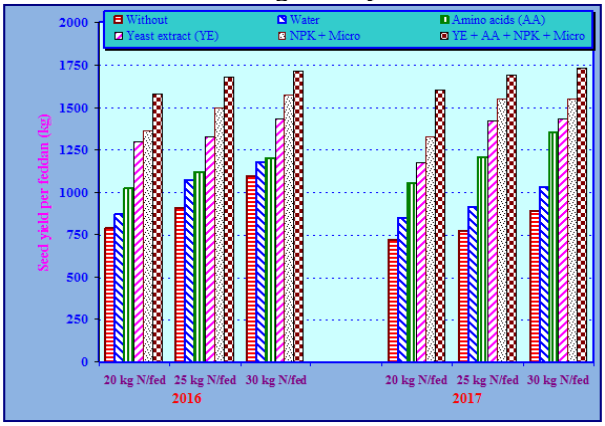

Fig. 5. Seed yield per feddan (kg) as influenced by the interaction among N-levels also foliar spraying transactions through 2016 plus 2017 years.

CONCLUSION

It can be deduced that mineral fertilizing sunflower cultivar Sakha-53 with 25 kg N per fed in addition foliar spraying with the mixture of AA, yeast extract and NPK + Micro (Fe, Mn and Cu) two times after 37 and 51 DFS in order to preserve high productivity at the same time decrease production expenses and ecological contamination under the ecological circumstances of El-Muhandis Village, Sherbin Center, Dakahlia Governorate, Egypt.

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تأثير مستويات السماد النيتروجينى ومعاملات الرش الورقى على إنتاجية عباد الشمس

محسن عبد العزيز بدوى ، أحمد نادر السيد عطيه ، صالح السيد سعده وأمل السيد السيد عوض

قسم المحاصيل – كلية الزراعة – جامعة المنصورة – مصر

أجريت تجربتان حقليتان فى قرية المهندس بمدينة شربين ، محافظة الدقهلية ، مصر خلال موسمى 2016 و2017 م. لدراسة تأثير بعض العمليات الزراعية التى تساهم فى زيادة إنتاجية وجودة بذور عباد الشمس مثل التسميد النيتروجينى ومعاملات الرش الورقى. أجريت التجارب فى تصميم الشرائح المتعامدة فى ثلاث مكررات حيث إحتوت الشرائح الرأسية على ثلاث مستويات من التسميد النيتروجينى كالتالى: 1- 20 كجم نيتروجين / فدان. 2- 25 كجم نيتروجين / فدان. 3- 30 كجم نيتروجين / فدان. أما الشرائح الأفقية فقد إشتملت على ست معاملات من الرش الورقى كالتالى: 1- بدون رش (معاملة المقارنة). 2- الرش الورقى بالمياه. 3- الرش الورقى بالأحماض الأمينية بمعدل 1.5 جم / لتر ماء في كل رشة. 4- الرش الورقى بمستخلص الخميرة بمعدل 150 مل / لتر ماء في كل رشة. 5- الرش الورقى بالعناصر الكبرى (النيتروجين ، الفوسفور والبوتاسيوم) والصغرى (الحديد ، المنجنيز والنحاس) فى صورة مركب الإسبتيما جرين بمعدل 1.5 جم / لتر ماء فى كل رشة. 6- الرش الورقى بخليط من الأحماض الأمينية ، مستخلص الخميرة ، العناصر الكبرى (النيتروجين ، الفوسفور والبوتاسيوم) والعناصر الصغرى (الحديد ، المنجنيز والنحاس) فى صورة مركب الإسبتيما جرين بمعدل 1.5 جم + 150 مل + 1.5 جم / لتر ماء على التوالي في كل رشة. (تم الرش مرتين بعد 37 و51 يوماً من الزراعة). أدى التسميد المعدنى لنباتات عباد الشمس بـ 30 كجم نيتروجين / فدان للحصول على أعلى القيم من صفات المحصول ومكوناته في الموسم الأول والثانى. أما التسميد المعدني بـ 25 كجم نيتروجين / فدان احتل المرتبة الثانية بعد التسميد بـ 30 كجم نيتروجين / فدان في الموسمين الأول والثاني من هذه الدراسة. في حين أدى التسميد المعدنى بـ 20 كجم نيتروجين / فدان للحصول على أقل القيم من جميع الصفات المدروسة. أشارت النتائج المتحصل عليها أن الرش الورقى لنباتات عباد الشمس مرتين بخليط من الأحماض الأمينية ، مستخلص الخميرة والعناصر الكبرى والصغرى (الحديد ، المنجنيز والنحاس) بمعدل 1.5 + 150 + 1.5 / لتر ماء كان أفضل معاملة من معاملات الرش الورقى تحت الدراسة تأثيراً على صفات المحصول ومكوناته ، حيث أنتجت هذه المعاملة أعلى القيم لجميع الصفات تحت الدراسة في كلا الموسمين. تلا هذه المعاملة الرش الورقى لنباتات عباد الشمس مرتين بالإسبتيما جرين كمصدر للحصول على العناصر الكبرى (النيتروجين ، الفوسفور والبوتاسيوم) والعناصر الصغرى (الحديد ، المنجنيز والنحاس) بمعدل 1.5 جم / لتر ماء في كل رشة. وكان للتفاعل بين التسميد النيتروجينى والرش الورقى تأثيراً معنوياً على جميع الصفات المدروسة ماعدا صفة قطر القرص خلال موسمى النمو. من النتائج المتحصل عليها من هذه الدراسة يمكن التوصية بالتسميد المعدنى بـ 25 كجم نيتروجين / فدان بالإضافة إلى الرش الورقي لنباتات عباد الشمس صنف سخا 53 مرتين بعد 37 و51 يوماً من الزراعة بخليط من الأحماض الأمينية ، مستخلص الخميرة والعناصر الكبرى (النيتروجين ، الفوسفور والبوتاسيوم) والعناصر الصغرى (الحديد ، المنجنيز والنحاس) بمعدل 1.5 + 150 + 1.5 / لتر ماء على التوالي في كل رشة وذلك للحصول على إنتاجية وجودة عالية لبذور عباد الشمس ، وفي نفس الوقت تقليل تكاليف الإنتاج والتلوث البيئي تحت الظروف البيئية لقرية المهندس ، مركز شربين ، محافظة الدقهلية ، مصر.